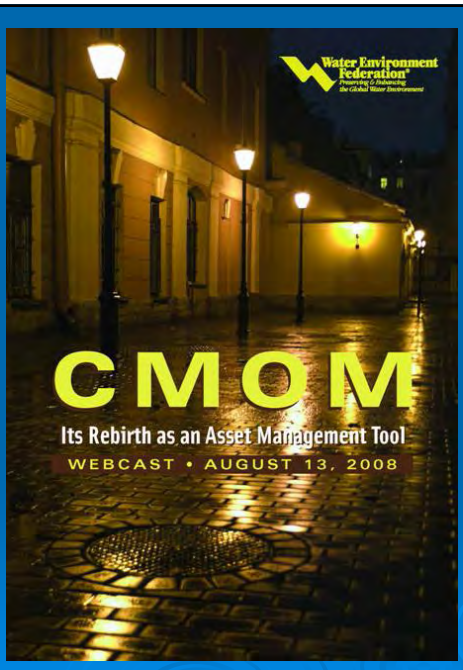


WEF® Distance Learning Webcast Series

AGENDA

- Welcome and Introduction
  - Jim Paluch
- CMOM's Regulatory Past, Evolving Present & Promising Future
  - Tim Keegan
- Buried Asset Management Institute (BAMI)
  - Tom Iseley
- Buried Infrastructure Management Program
  - Bob Kerry & Pierre Mikhail
- Questions & Answers / Wrap-up

Moderator

James J. Paluch

Assistant Superintendent /
Collection System Operations

Joint Meeting of Essex and Union Counties

CMOM
Our Aging Infrastructure's Phoenix

CMOM's Regulatory Past, Evolving Present & Promising Future

Timothy Keegan, P.E.

Senior Consultant / Associate

Brown and Caldwell

REBIRTH (?) OF CMOM

Regulatory Past
Evolving Present
Promising Future

Tim Keegan, P.E.
Brown and Caldwell

BROWN AND CALDWELL

What is CMOM?

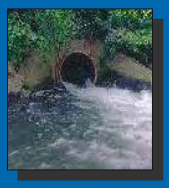
- ***C****apacity*
  - Hydraulic capacity of gravity system, pump stations & forcemains
- ***M****anagement*
  - Performance measures, Training, Budgeting, CIP, Safety
- ***O****peration*
  - Pump Stations other Programs
- ***M****aintenance*
  - Preventative, Corrective & Emergency Maintenance Programs

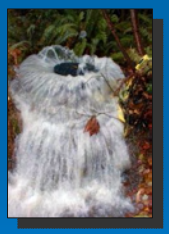
A proposed SSO rule that applies to ***all*** sanitary sewer collection systems. **An update to the CWA**

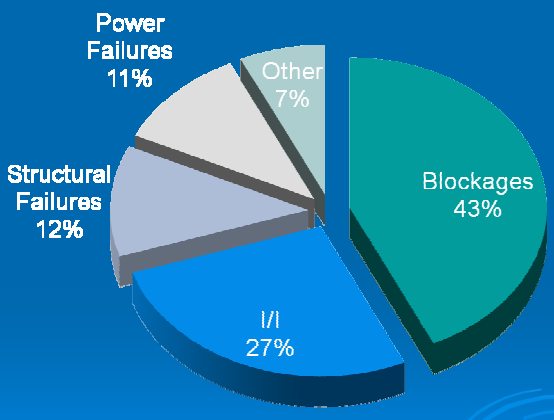
Why CMOM?

- Achieve better collection system performance
- Over 40,000 SSO's reported each year
  - Est. 75,000 each year; 10 billion gallons/yr
  - Plus ~ same number of basement backups
- Collection systems are public health infrastructures
- SSO's are symptoms of failing infrastructure

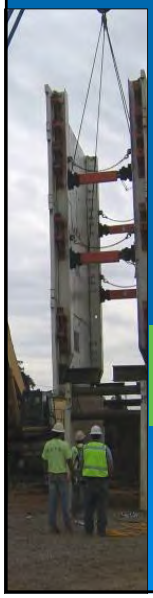
What causes SSO's?







Objective of the proposed rule

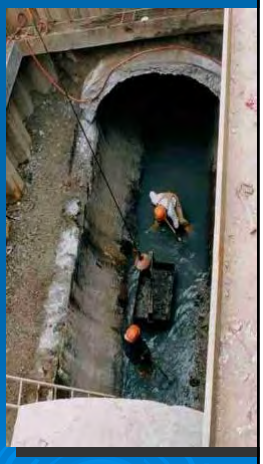


- Reduce health / environmental risks
- Reduce equipment and operational failures
- Protect the nations collection system assets
- Extend the life of systems and equipment
- Establish long term funding and strategy for repair, rehabilitation and replacement

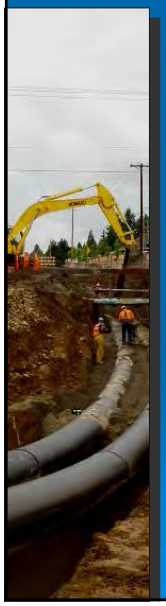
That have been identified as a result of, or contribute to, SSO's

What is the challenge?

- 20,000+ wastewater collection systems in the United States
- 1 million miles of pipe
- $2 to $3 trillion infrastructure investment
- $500 billion in rehabilitation needs



The CMOM genesis



- Evolved from the effort to identify the major causes of SSO's & to resolve enforcement inconsistency
- Initially implemented by USEPA Region IV as the MOM (Management, Operations and Maintenance) program
- Not yet adopted as a rule but used by regulators as a tool to evaluate performance
- The proposed rule will effect ***every*** collection system in the U.S.

How long have we been talking CMOM?

- 1994: EPA begins process because of inconsistent enforcement of CWA violations
- 2001: Draft notice of proposed rulemaking signed. Withdrawn the same month
- EPA "encouraging" CMOM through NPDES permits, Consent Order/Decree/Judicial Order/ Stipulation and other enforcement mechanisms on a case by case basis
- Has gained critical mass at state and regional level
- See August 2007 EPA documents (http://www.epa.gov)

What's going on now?

Model NPDES permit requirements for municipal sanitary sewer collection systems and SSO's

- When permits are issued
  - Immediate reporting of SSO
  - Written reports
  - 3rd party notice
  - Record keeping

What is EPA saying?

- Permit coverage for municipal ***satellite collection systems***

What is EPA saying?

- Definition of an overflow now ***includes a backup into a building*** (other than a backup caused solely by a blockage or other malfunction in a privately owned sewer or building lateral), ***even if that overflow does not reach the waters of the United States***.

What is EPA saying?

- Written reports include, among other things:
  - A description of the sewer system component from which the release occurred Suspected cause
  - Steps to reduce, eliminate and prevent re-occurrence of the overflow and a schedule of major milestones for those steps
  - Estimated number of persons who came in contact with the wastewater
  - Steps to mitigate the impacts and schedule of major milestones

What is EPA saying?

- Proper Operation and Maintenance
  - Permits should clarify requirements for proper operation and maintenance of the collection system. (see 40 CFR 122.41(d) and (e)). This may include requiring the development and implementation of capacity, management, operation and maintenance (CMOM) programs.

Why do all of this?

- CMOM is intended to achieve long term, utility-specific, capacity, management, operations, and maintenance business practices that lead to improved system performance and reduced SSO's.

Or, to put it another way:

- Higher levels of service to community
- Reduced risk of regulatory non-compliance
- Efficient delivery of services $$$$

What are the benefits of the CMOM approach?

- Forces utilities to look at their operation in a different light & provides a strategy to the utility that results in:
  - Improved level of service
  - Better management of valuable assets
  - Better use of allocated budgets for O&M

Benefits of the CMOM approach

- Reduced liability - “Affirmative Defense” 3rd party lawsuits
- Move closer to regulatory compliance, state, regional, federal
- Information-based decision making vs. gut feeling
- Establishes a process for “Continuous Improvement”
- Reduce “Brain Drain”

Where is CMOM going?

Where is CMOM Going?

- Regulatory
  - Does not appear to be moving forward as a stand alone regulation; The Clean Water Act has teeth
  - EPA is showing more interest in the relationship between the Regional POTW and the Satellite Utilities
  - CMOM language is incorporated in permits and enforcement actions across the country
- Forward thinking utilities embrace CMOM as an opportunity to improve

Status Quo Is Not Acceptable

- Deteriorating, aging infrastructure
- Increasing customer expectations
- Third party or NGO involvement
- Cost of doing business ⇧
  Funding ⇩

How Can We Increase The Level of Service Without A Negative Cost Impact?

- Maybe we can't, at least with short term $$, but with knowledge we can work with the community and the decision makers so the consequences or the risk associated with decisions are known
- Define the best option that provides an acceptable level of service at the lowest life cycle cost

What Do We Need To Know?

- Know the system
  - What assets does the utility own?
  - Where are the assets located?
  - What is the condition of the assets?
  - What is the proper level of maintenance?
  - What is the asset's useful remaining life?
  - How will we replace or repair the asset?
  - What is our expected capital outlay in 5, 10, 20, 30 years or more?

What Do The Customers Expect?

- Customer/stakeholder expectations (Level of Service)
  - How many spills or backups will be tolerated?
  - What price are the customers willing to pay?
  - Do the customers know where their money is going?

Where Is CMOM Going?

- Back to the Future
  - CMOM is heading back (?) to what it was always intended to be:

A set of effective business policies, practices and procedures that allow the decision-makers to make sound judgments based on facts and customer expectations

"The time to repair the roof is when the sun is shining" – John F. Kennedy

- **Be Proactive**
  - Initiate CMOM / AM programs prior to regulatory intervention
- CMOM is an opportunity to:
  - Provide a high level of service
  - Meet federal, state and local regulations
  - Be cost competitive
  - Avoid "the big one"

Thank You!

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BROWN AND CALDWELL

Buried Asset Management Institute – International (BAMI)

Tom Iseley, Ph.D., P.E.

Professor / Director of Construction Engineering Management Technology

Purdue University School of Engineering & Technology

The Buried Asset Management Institute-International (BAMI-I)

Establishment of a Center of Excellence and the EPA Cooperative Agreement

Presenter: Tom Iseley

Asset Management Definition 1:

- ***A combination of management, financial, economic, engineering and other practices applied to (physical) assets which has the objective of maximizing the value derived from an asset stock over the whole life cycle, within the context of delivering appropriate levels of service to customers, communities and the environment, and at an acceptable level of risk.***

Asset Management Definition 2:

- Address customers' immediate service requirements while managing the system assets to meet long-term requirements, reliably, & costs effectively
- Long-term AM results in:
  - Increased Asset Life
  - Decreased Maintenance Costs
  - Decreased Capital Costs
  - Permits planned spending based on critical needs.
  - Allows scarce financial resources to be effectively used.
  - Potentially increases revenues by revealing opportunities to sell or lease land or retired assets, sell excess capacity, provide outside services, or initiate new business.

Challenge!

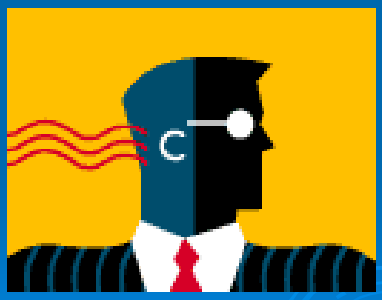
- These definitions sound like “motherhood” and “apple pie.”
- They can apply to all assets.
- What about CMOM & GASB 34?
- How can we achieve these goals for water and sewer underground infrastructure?

Water & Sewer
Underground Infrastructure Systems

- Out-of-sight - Out-of-mind!
- Taken for granted by all.
- Our message: We keep emphasizing that our buried infrastructure systems are the life support systems for society- arteries, blood vessels & nerve systems that determine our quality of life and economic development/stability.

The big challenge?

- How do we get key political decision makers to listen?



Water & Sewer Champion

- Mayor Shirley Franklin – Atlanta
  - Atlanta Journal-Constitution – July 15, 2002

Atlanta eager to develop world-class sewer system

- People worldwide dream of living in a community with clean water, plentiful jobs and affordable housing. Over the Next 12 years, Atlanta will make its largest investment ever in such a dream. To assure high water quality and long-term economic stability for ourselves, our children and grandchildren, we are embarking on a $3B sewer improvement program.
- Most of this investment is required under a federal court order
- ***It is our opportunity to develop a world-class sewer system***

Water & Sewer Champion

- Mayor Shirley Franklin – Atlanta Highlights from a speech on 10/16/02 on ***"Clean Water Atlanta"***
  - **The future of Atlanta depends on:**
    - **Economic growth;**
    - **Jobs for all who want to work;**
    - **Keeping the City an affordable place to live;**
    - **Keeping it attractive and affordable quality of life;**
    - **All of these depend on clean water.**
  - ***Clean Water Atlanta*** **program established.**

Our responsibility is….

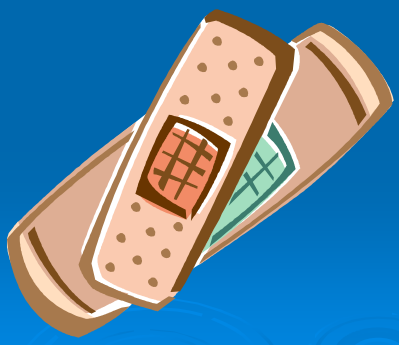
to have a sewer system that works; our responsibility for clean streams and rivers --- we owe this to our neighbors, to our children and to the environment. It is our responsibility to future generations.

Mayor Franklin
Highlights ***"Clean Water Atlanta"*** Speech

- When it comes to sewers and clean water……..

I'm not interested in delay. We've already had too much delay in Atlanta.

I'm not interested in short term solutions. We've already had too many band-aids in Atlanta.



I'm not interested in easy answers. We've avoided the tough decisions for too long in Atlanta.

Mayor Franklin's Actions

- Formed the Department of Watershed Management (DWM)
- http://www.atlantawatershed.org/media/iamthecity.htm

DWM responsible for:

- Drinking Water
- Sanitary sewer
- Storm sewer

- Appointed Jack Ravan as Commissioner

The challenges of Atlanta's DWM gave birth to:

- BAMI – Buried Asset Management Institute
- What's in the name?
  - BAMI's focus will be on underground infrastructure
  - Our underground infrastructure are assets
  - These assets must be managed properly to provide customers with expected services at the lowest cost

BAMI - Mission Statement

- To provide a center of excellence for owners of underground water infrastructure to join with industry and researchers, using sound science, to evaluate and/or develop buried asset management protocols for application worldwide to benefit ratepayers and other stakeholders by:
  - Protecting public health
  - Improving the environment
  - Maximizing asset life-cycle value
  - Sustaining economic development
  - Enhancing the quality of life

Fundamentals: Answer 5 core questions

- What is the current state of my assets?
  - Inventory assets
  - Assess condition
  - Determine residual level
  - Determine replacement cost & date

Fundamentals: Answer 5 core questions

- What is the required level of service?
- Which assets are critical to sustain performance?
- What are the best O&M and CIP strategies?
- What is the best funding strategy?

AM Key Elements

- Level of service definition
- Selection of performance goals
- Information system
- Asset identification and valuation
- Failure impact evaluation & risk mgt.
- Condition assessment
- Rehab., renewal, & replacement
- Capacity assessment & assurance
- Maintenance analysis & planning
- Financial management
- Continuous improvement

AM elements must be embraced & implemented by:

- Management at all levels
- Accounting/finance
- Operations & maintenance
- Engineering
- Administrative
- Field staff

Bottom Line

- It's all about people
- Getting people to understand how what they do every day impacts achieving AM objectives
- How to effect culture change
- How to build organizational strength
- How to insure the organization provides a career path to all employees.

- **Develop educational programs**
  - **Training & educational programs must move beyond awareness to assisting with organizational cultural change challenges required to implement advanced AM principles and practices**
  - **A Suggested Model:**
    - **Phase 1: Overview 3-4 hours Sr. Mgt. Team**
    - **Phase 2: Workshop 2-3 days Mgt. Team**
    - **Phase 3: Development of a long-term program with team participation and commitment**
      - **Teams**
        - **Engineering**
        - **O&M**
        - **Legal**
        - **Procurement**
        - **CIP**

- The most difficult part of implementing an effective AM program is getting the total buy-in including the field people
- Develop O&M and pipe rehabilitation training in-house
- Developing training programs with Unions to train employees with skills for self-installation
- Selected 5 trenchless processes
  - Pipe bursting
  - Large pipe diameter renewal
  - Manhole renewal
  - Manhole-to-manhole pipe renewal
  - Lateral renewal

Public Awareness is Critical

- Get message to political decision makers & public
  - Committed to working with PIRC and NASSCO as sponsors for the development of a broadcast and non-broadcast media package being developed by Penn State Public Broadcasting
  - "*America Underground: A Public Communications Package on the U.S. Water & Wastewater Infrastructure"*
    - Proposal developed – funds provided by NASSCO-1 year
    - Project cost - $850,000
    - Establishing a IAC-Industry Advisory Council

Thank you!

- Questions ?

- Contact:
  - Tom Iseley, Ph.D., P.E.
  - Tel.: (317) 278 – 4970
  - E-mail: dtiseley@iupui.edu

Buried Infrastructure Management Program

Bob Kerry
Project Manager

InfraMetrix, LLC

&

Pierre Mikhail
Project Manager

InfraMetrix, LLC

A Practical Approach to Achieving CMOM Objectives

Bob Kerry and Pierre Mikhail
InfraMetrix LLC Tampa, FL
August 13, 2008

The State of Our Gravity Sewer Assets

Current US Inventory

- 1,000,000 miles
- 25% is more than 40 years old
- 75% is 12-inch or smaller
- 44% is constructed of clay or concrete

Annual Investments

- $4.5 billion/yr spent on R and R
- $110 million/yr spent on cleaning and CCTV
- The O&M gap may approach $150 billion over the next 20 years (USEPA)

Innovative Approaches Are Required to Quickly and Affordably Address Needs

Triage Approach of Gravity Sewer Management

"The process of prioritizing maintenance and capital expenditures based on risk (consequence of failure x condition)."

Presentation Objectives

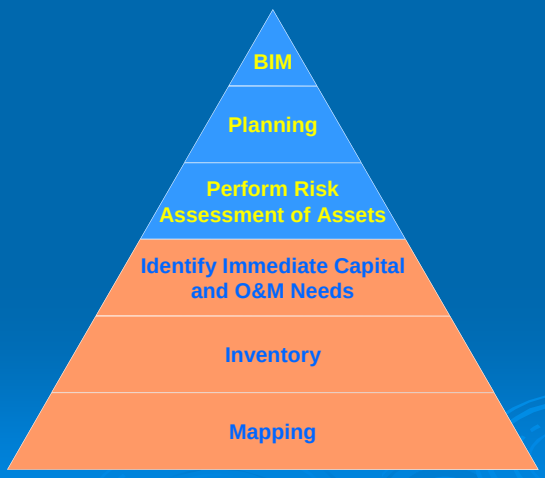
Webcast attendees will:

- Recognize cost, time and management benefits of a triage approach to gravity sewer management
- Determine how GIS helps to improve sewer performance
- Learn how to maximize the benefits of your inspection dollars
- Locate immediate needs quickly and before overflows and failure occur
- Learn how to get the most life out of existing underground infrastructure
- Understand the benefits of the triage approach through Case Studies

Critical Questions For Improving Asset Performance

- What assets do we own?
- Where are our assets located?
- What are the maintenance needs of our assets?
- What is the hydraulic and structural condition of our assets?
- What are our immediate capital and O&M needs?
- What are our probabilities and consequences of failure?
- At what point is it necessary to take action?
- How much will it cost and how long will it take to achieve the desired level of service?

Proactive Management Optimization



Triage Approach To Collection System Management

- Utilizes powerful GIS software applications
- Obtains GPS point for assets / digital mapping
- Utilizes ZOOM camera technology
- Integrates all information (media)
- Allows proactive management

Triage - Definition

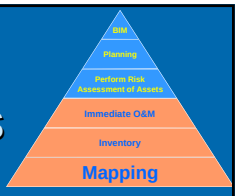
Medical

- Prioritization of patients for medical treatment
- The process of prioritizing sick or injured people for treatment according to the seriousness of the condition or injury

Gravity Sewer

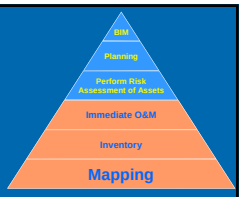
- The process of prioritizing system components (based on Capital and O&M needs) for treatment based on criticality (the defined set of failure modes x the consequence of failure)

Triage Approach Geographic Information Systems (GIS)



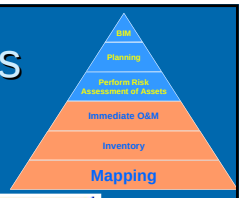
- GIS can be an effective tool for managing sewer collection systems
- Verify the buried infrastructure asset location ***and*** operating condition on the field
- Continuously update GIS for the entire infrastructure
- Incorporate construction additions / changes

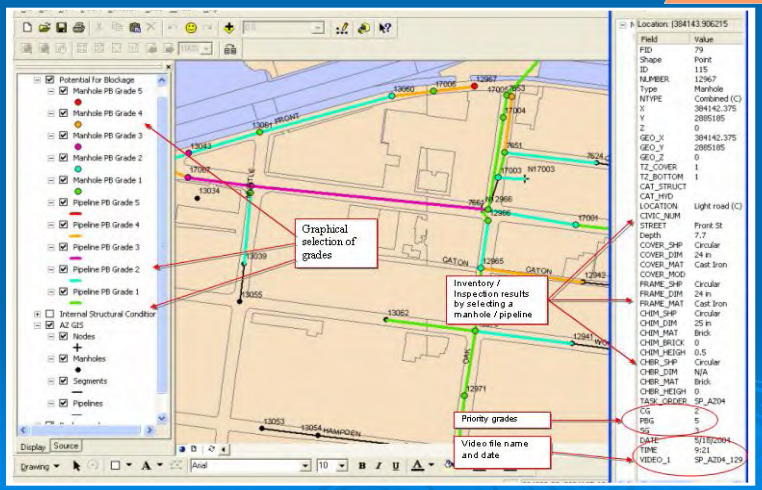
GIS allows you to…



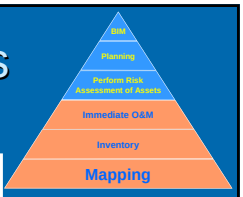
- Identify and label assets
- Define and document location / current condition
- Support work order system
- Include historical information / operator knowledge
- Convey information to public / regulatory agencies / elected officials

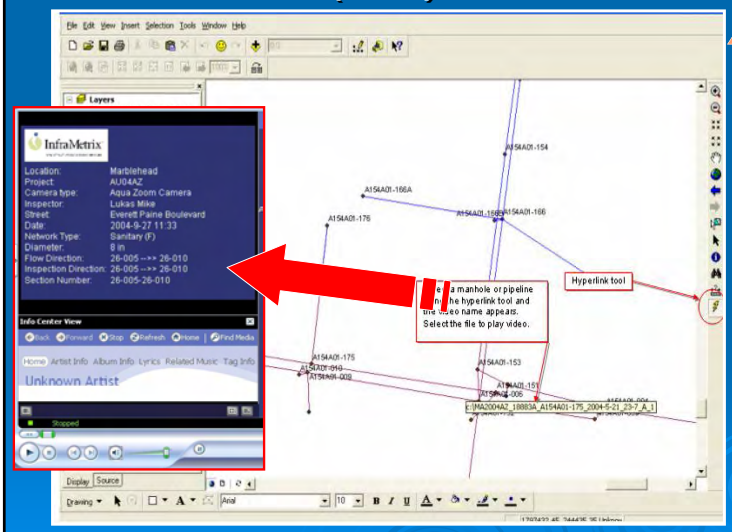
Geographic Information Systems (GIS)



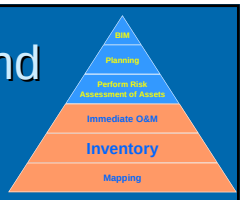


Geographic Information Systems (GIS)



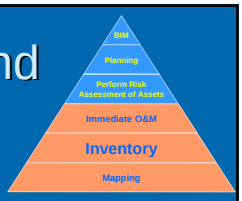


Method of System Inventory and Condition Assessment

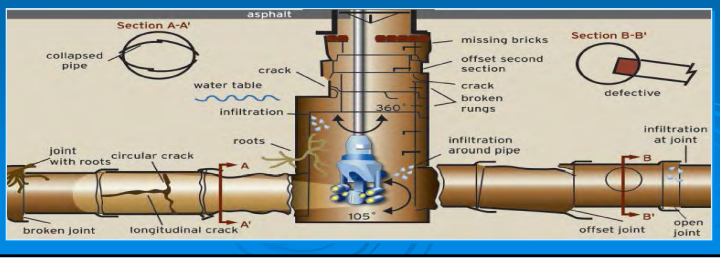


- Obtain GPS Information for all Assets
- Zoom Camera Inspection
  - Manholes
    - No Confined Space Entry
    - Permanent Comprehensive Video Documentation of Inventory and Condition
    - Design Ready Manhole Data

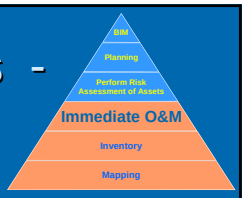
Method of System Inventory and Condition Assessment



- Zoom Camera Inspection
  - Pipelines
    - Rapid Screening of Pipelines (up to 10,000 lf/day)
    - No Pre-cleaning or Flow Control Required
    - Quickly Identify Immediate Structural and O&M Needs
    - Permanent Video Documentation of Condition for Evaluation of Criticality



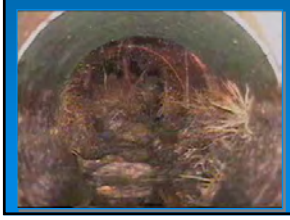
Condition Grade Ratings - PACP/MACP



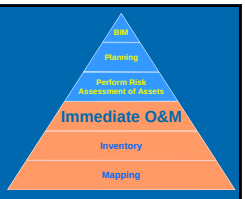
- Safety
- Structural
- O&M
- I/I

Grade 5 – failed or failure imminent
Grade 4 – failure likely in foreseeable future
Grade 3 – failure unlikely in near future
Grade 2 – minimal failure risk
Grade 1 – acceptable condition

Weeper, Dripper, Runner & Gusher



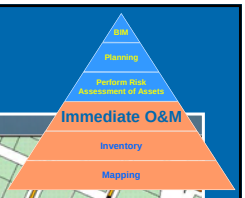
Triage Approach Information Foundation

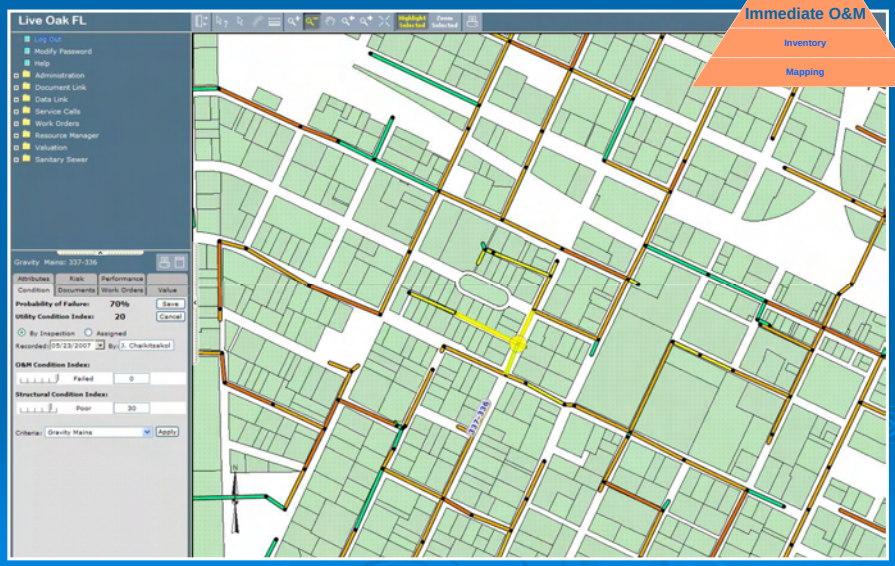


Results of GPS, GIS, and ZOOM Activities

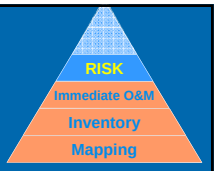
- Develop/Verify Existing System Mapping
- Confirm Attribute Data
- Identify O&M Condition and Needs
- Identify Structural Condition and Capital Needs
- Provide a Basis for Comprehensive Assessment, Planning and Management

Asset Management





Risk Assessment, Planning, Infrastructure Management

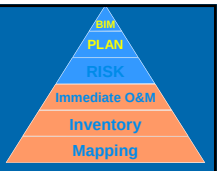


RISK = Consequence of Failure X Probability of Failure

Consequence of Failure Ratings

				Risk Scores (Consequence Score x Failure Probability)						
	Failure Probability:			1%	90%	50%		10%	90%	High
Consequence	Rating	Weight	Score	Life Left	Capacity	Condition	Efficiency	I / I	Sulfide	Scores
Environmental Impact	High	0.100	5.00		4.50	2.50		0.50		4.50
Health and Safety	Mod	0.200	8.00		7.20	4.00			7.20	7.20
High Cost to Operate	High	0.050	2.50	0.03	2.25	1.25		0.25	2.25	2.25
High Cost to Repair	Mod	0.100	4.00	0.04	3.60	2.00			3.60	3.60
Loss of Service	High	0.100	5.00	0.05	4.50	2.50				4.50
Property Damage	Low	0.100	2.50		2.25	1.25				2.25
Public Relations	None	0.050	0.50		0.45	0.25			0.45	0.45
Regulatory Impact	High	0.150	7.50	0.08	6.75	3.75		0.75	6.75	6.75
Disruption to Community	Low	0.150	3.75		3.38	1.88				3.38
	Consequence Factor:		8.00		Failure Probability:	90%			Utility Risk Factor:	7.20

Risk Assessment, Planning, Infrastructure Management



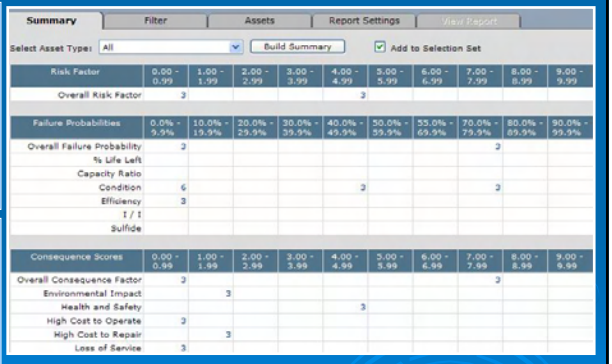
The Top of the BIM triangle: Planning

Develop…

- Level of Service Goals
- Maintenance strategy
- Risk reduction plans
- What-if Budget scenarios

Information is Available to

- Track Service Calls
- Track work activity Costs
- Track Condition & Risk
- What-if Capital Planning
- Report your progress!



Case Histories

- Project: Live Oak, FL
- Zoom Inspection
  - 655 manholes
  - 784 pipelines (195,000 lf)
- Findings
  - 123 manholes (19%) with O&M 4 or 5
  - 27 manholes (4%) with Structural 4 or 5
  - 239 pipelines (30%) with O&M 4 or 5
  - 135 pipelines (17%) with Structural 4 or 5

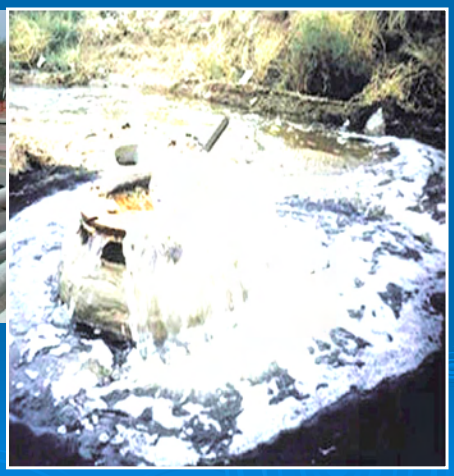
Case Histories

- Project: St-Croix, USVI
- Zoom Inspection
  - 1362 manholes
  - 1743 pipelines (450,000 lf)
- Findings
  - 560 manholes (41%) with O&M 4 or 5
  - 508 manholes (37%) with Structural 4 or 5
  - 370 pipelines (21%) with O&M 4 or 5
  - 131 pipelines (7.5%) with Structural 4 or 5

Case Histories

- Project: Hillsborough County, FL
- Zoom Inspection
  - 28,672 manholes
  - 29,100 pipelines (6,100,000 lf)
- Findings
  - 1208 manholes (4.3%) with O&M 4 or 5
  - 1506 manholes (5.4%) with Structural 4 or 5
  - 3296 pipelines (12%) with O&M 4 or 5
  - 327 pipelines (1.2%) with Structural 4 or 5

Prevent Catastrophic Failure



A Brighter Outlook with the Triage Approach

- Zoom Inspection Can Proceed Up to 4 Times Faster Than Standard Cleaning and CCTV Inspection
- Zoom Screening Results show 20% - 35% of Assets Actually Require Cleaning to Address O&M Issues
- Cleaning: 1,000,000 Miles Focuses Down to Worst Case of 350,000 Miles
- Zoom Screening Results Show 0% - 5% of Assets Actually Require In-line CCTV Inspection to address Structural and Capital Issues
- Line Inspection : 1,000,000 Miles Focuses Down to Worst Case of 50,000 Miles
- Use Unspent Inspection Dollars to Fund Repairs
- Proactively Manage Collection Systems With Easy to Access Historical and Current Inventory and Condition Information

Proactive Management Benefits Using the Triage Approach

- Mapping: Locate All Assets and Confirm Physical Characteristics
- Inventory: Identify Maintenance Needs, Hydraulic, and Structural Condition of All Manholes and Pipelines
- Save Time and Money: Quickly Inspect Manholes and Screen Pipelines (up to 10,000 lf/day) Affordably (About Half the Cost of Cleaning and CCTV)
- Efficiency: Avoid Unnecessary Cleaning and Inline Inspection Freeing Up Funds for Addressing Maintenance and Structural needs
- Comprehensive Planning: Assign Risk of Failure of each Manhole and Pipeline to Determine When to Perform Future Re-inspection and Perform required Maintenance and Capital Improvements
- Improve Performance: Efficient and Effective Approach That Addresses Immediate Needs, and Prioritizes Re-inspection, Future Maintenance, and Capital Improvements

Questions?

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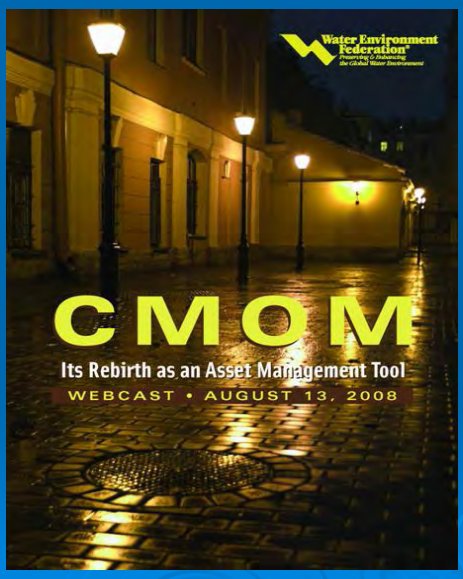
Thank You !



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